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ECE 153B

Overview: Problem statement:

In the sport of powerlifting (which tests a lifter's one rep max strength in the squat, bench press, and deadlift), the bench press has 3 commands given by the head judge: "start", "press", and "rack". Once the lifter unracks the bar on bench press, the lifter has to wait for the head judge to give a "start" command. After the "start command," the lifter lowers and rests the bar to his/her chest, and waits for the head judge to give the "press" command once s/he sees the bar motionless on the lifter's chest. In other words, the lifter must pause the bar on his/her chest and wait for someone to give the "press" command.

In training, many powerlifters try to emulate this pause, but often cut the length of time it should actually be. A lifter might think they did a competition-length pause but in actuality it is noticeably shorter. To remedy this, training partners often give press commands to a powerlifter to ensure that their bench press is as close to competition standard as possible. However, not everyone lifts with a training partner. Powerlifters who train alone face the problem of not pausing long enough.

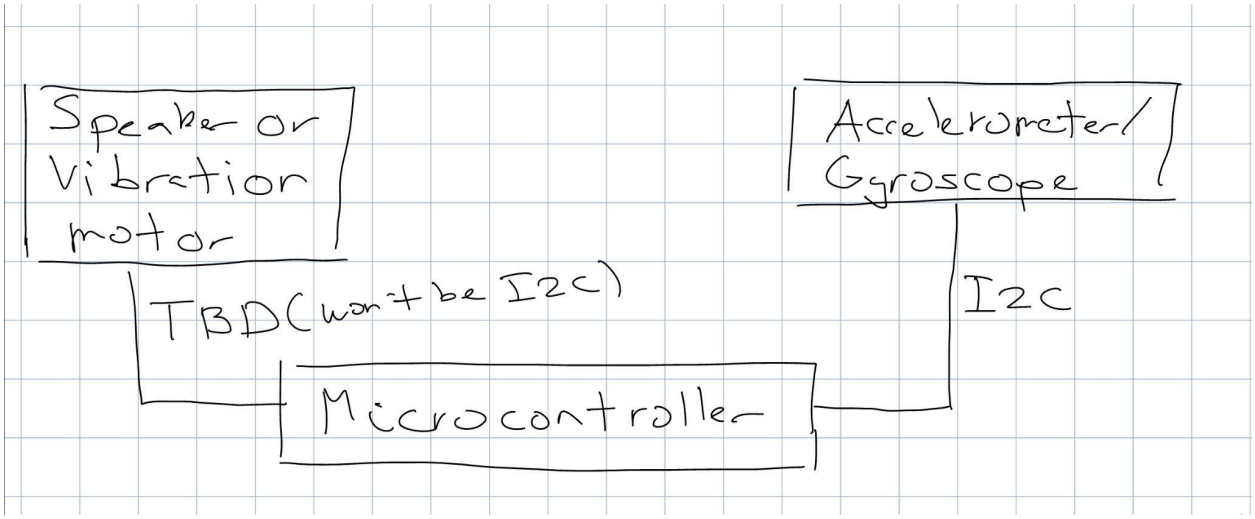
Project Idea:

We plan on creating an embedded system that emulates this "press" command given by a head judge in a powerlifting meet. The device will tentatively be placed around the lifter's forearm. On the bench press, when the lifter lowers and pauses the bar to his/her chest, the device will start a one second timer. Once that one second has occurred, the microcontroller will generate an interrupt and a speaker or vibration motor (we haven't decided yet) will emit an audible/sensory signal, indicating that the lifter can now press the bar. Additional functionality might be added, such as counting the number of reps done in a set, as well as tracking velocity from rep to rep. Tracking velocity for lifts is not only used in powerlifting (as velocity is directly correlated to how close to failure a lifter is), but it is also used in other barbell sports.

Details:

For peripherals, we plan on using an accelerometer and either a vibration motor or a speaker. For the accelerometer we are using the GY-521 MPU-6050 MPU6050 3 Axis Accelerometer Gyroscope (which uses I2C). We haven't decided on whether to use a vibration motor or a speaker to indicate to the lifter when to press, but that will be finalized before project demos begin, depending on availability and delivery timeline.

Block diagram:



Responsibility List:

Brandon:

- Research what speaker or vibration motor to buy
- Design prototype
- Interface accelerometer with STM32L4VGTx
- Test device

Ananth:

- Test device
- Interfacing feedback device with STM32L4VGTx

Software Structure:

- Read accelerometer value
- Generate interrupt once accelerometer value is within a certain threshold
- General purpose timer that starts when accelerometer value is within certain threshold
- General purpose timer interrupt generated after one second
- Initialization and configuration of GPIO ports
- I2C communication and tbd serial communication